the opposite side and the two ends of the box are far enough off that they may be regarded as practically at an infinite distance from the electrodes.

When $c=1$, the equation becomes $r^2=r_1 r_2$: so that the section of the cylindrical surface is a rectangular hyperbola.

A curve determined by experiment is drawn in Plate 2. fig. 12, very near to the position of this hyperbola; but as one of the electrodes was at the centre of the box, the forms of the equipotential curves will be slightly changed, because of the influence of the opposite side and ends of the box.

At the vertex the two curves coincide, and, measured along the latus rectum of the hyperbola, the distance between them is only 5 millims. Since the distance between the battery-electrodes is one half the breadth of the box, the influence of the opposite side and ends of the box will be quite sufficient to account for so small a difference. Thus we see that with linear electrodes there is a very satisfactory agreement between theory and experiment.

The equipotential curves for Case 10, with linear electrodes in the liquid, are theoretically the same as those for Case 5, with points on a sheet of tinfoil for electrodes. A comparison of the figures (Plate 1. fig. 5 and Plate 2. fig. 12) which are laid down from the experimental results shows how closely they agree, and may be taken to be an independent proof of the accuracy of the theory of electrical distribution.

November 18, 1875.

Dr. J. DALTON HOOKER, C.B., President, in the Chair.

In pursuance of the Statutes, notice of the ensuing Anniversary Meeting was given from the Chair.

Mr. Etheridge, Mr. F. Galton, Mr. Newmarch, Dr. W. Pole, and Mr. W. W. Smyth, having been nominated by the President, were elected by ballot Auditors of the Treasurer's Accounts on the part of the Society.

Mr. Robert Lewis John Ellery (elected 1873), Mr. James Geikie, Dr. Emanuel Klein, Prof. E. Ray Lankester, Mr. Robert Stirling Newall, and the Earl of Carnarvon were admitted into the Society.

The following extract from the Will of the late Sir Charles Wheatstone, F.R.S., in a letter from Mr. Robert Sabine, one of the executors, was read:—"I leave to the Royal Society of London for the Promotion of Natural Knowledge the Portrait of the Hon. Robert Boyle, and all the framed Portraits of scientific men now in my possession; and I also bequeath to the said Royal Society the sum of Five Hundred Pounds, to be applied to the purposes of the Wollaston Donation Fund."

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The President expressed his regret, which would be shared by the Society, that intelligence had been received by the Admiralty of the decease, at sea, of Dr. von Willemöes-Suhm, a distinguished young Naturalist attached to the Scientific Staff of the 'Challenger' Expedition.

The Presents received were laid on the table, and thanks ordered for them.

A direct-vision compound prism by Merz, the gift of Mr. Gassiot, was presented to the Society. It is regarded by the maker as one of remarkable excellence, and is composed of a central prism, of large angle, formed of peculiarly heavy lead glass, with opposed prisms of crown glass cemented to its two faces. It is capable of taking in a pencil of rays of $28\frac{1}{2}$ lines in width. The indices of refraction, in the heavy glass, of Fraunhofer's lines C, D, E, F are given by M. Merz as follows :—

$$C_n = 1{\cdot}7389.$$
$$D_n = 1{\cdot}7513.$$
$$E_n = 1{\cdot}7621.$$
$$F_n = 1{\cdot}7723.$$

Hence the dispersion is almost double that of ordinary flint glass.

The following Papers were read :—

I. "Report to the Hydrographer of the Admiralty on the Cruise of H.M.S. 'Challenger' from June to August 1875." By Prof. Wyville Thomson, F.R.S., Director of the Civilian Scientific Staff on Board. (Published by permission of the Lords of the Admiralty.) Received October 28, 1875.

[Plates 3-7.]

Hilo Hawaii, August 18, 1875.

Sir,—The 'Challenger' left Yokohama on the 16th of June, and ran an easterly course between the parallels of 35° and 40° north latitude, as far as the meridian of 155° east. We then turned nearly directly southwards and reached Honolulu on the 27th of July. The weather throughout was sufficiently favourable; shortly after leaving Yokohama there was a good deal of swell, which interfered somewhat with our dredging-operations and caused the loss of a good deal of time; we established, however, 24 observing stations, at each of which most of the desired observations were made. On the 17th of June we sounded in 1875 fathoms, with a bottom of bluish-grey clay and a bottom-temperature of 1°·7 C., 40 miles to the south-east of No-Sima Lighthouse. The trawl was put over, and it brought up a large quantity of the bottom, which showed the clay was in a peculiar concretionary state, run together into coherent lumps, which were bored in all directions by an Annelid of the Aphroditacean group. In many cases the Annelids were still in the burrows. Among the clay there were large lumps of grey pumice. The trawl contained several fishes (belonging, as usual, chiefly to the family Macruridæ)

and a large number of Echinoderms, chiefly flexible sea-urchins, ophiurids, and starfishes of the genus *Brisinga*. The hydroid zoophytes were represented by a very remarkable species, apparently referable to the genus *Monocaulon* of Sars, a *Corymorpha*-like solitary polyp with adelocodonic gonophores; but instead of being of the proportions usual in its group, the stem in one of our specimens measured upwards of seven feet in height, while the polyp-head was nine inches in diameter across the proximal row of tentacles. We afterwards got another fine example of the same species at a depth of 2900 fathoms (Station 248). The temperature of the surface of the sea stood during the day at nearly 23° C., considerably above the temperature of the air; and a serial sounding gave the isotherm of 10° C. at a depth of little more than 200 fathoms. We were therefore evidently under the thermic influence of the Japan current, which was found by observation to be running in an easterly direction at a rate of $1\frac{1}{2}$ knot an hour. The thermometers registered a uniform temperature of 1°·7 C. from a depth of 1000 fathoms to the bottom. About twenty Albatrosses, of a nearly uniform brown plumage with whitish heads (probably the young of the common North-Pacific species in their second year's plumage), followed the ship.

On the following day there was a stiff breeze from the southward, with a heavy sea. We sounded, however, successfully in 3950 fathoms, our deepest sounding in the North Pacific—position by dead reckoning lat. 34° 43′ N., long. 144° 2′ E., with a bottom of "red clay." The gale continued on the 19th, and the weather prevented our attempting to trawl; but a sounding in 3625 fathoms and serial temperatures to 1500 fathoms were obtained. At both of the two latter stations the high surface-temperature was maintained; and the position of the isotherm of 10° C. at station 239, at a depth of nearly 300 fathoms, indicates that up to this point, at all events, there was no diminution in the influence of the "Kuro-Siwo."

On the 21st we sounded in 2900 fathoms, with a bottom of "red clay." An attempt was made to trawl; but the sea was still running high, and in hauling in the line parted.

The temperature-observations gave a singular result. The surface-temperature had fallen to 18°·2 C., and the belt of water above 10° C. was reduced in depth to considerably less than 100 fathoms, while all the isotherms, at all events to a depth of 400 fathoms, rose in proportion. There seems to be little doubt, from a comparison of the American temperature-results with our own, that this sudden diminution of temperature is due to a cold surface-flow from the sea of Okhotsk, probably through Pico Channel or Vries Strait. Very likely its effect may not be found to be constant; and at this season it possibly attains its maximum from the melting of the snow over the vast region drained by the Amoor and the Udi and Siberian rivers with a southern outflow.

June 23.—We sounded in 2300 fathoms, with a bottom of "red clay."

The trawl brought up a quantity of lumps of pumice, more or less altered and more or less coated with manganese. Animals of all the invertebrate groups were abundant, free, and attached to the stones; but the assemblage was in no way remarkable. At this station the effect of the cold current was already almost entirely lost, the isotherm of 10° C. having resumed its position at a depth of about 200 fathoms.

On the 26th of June we sounded in 2800 fathoms. Temperature-soundings were taken to the usual depth; and the dredging-line was then veered to about 3000 fathoms with a cwt. lead and one towing-net at the end, two nets 250 fathoms from the end, and two more at a distance of about 1000 fathoms. The line with the nets was slowly dragged along for a time with the drift of the ship and hauled in. On carefully washing the nets and examining their contents several forms were met with which apparently do not occur on the surface, particularly a number of species of a group which is, so far as we know, entirely undescribed. It seems to be intermediate between the Radiolarians and the Foraminifera, resembling the former in the condition and appearance of the sarcode and in the siliceous composition of the test, and the latter in external form. The broken tests of these organisms are extremely abundant in the "red-clay" soundings; a sufficient number of observations has not yet been made to enable us to say with certainty what is their bathymetrical distribution. On the 28th we adopted a plan which we find extremely convenient at great depths, when we have reason to feel tolerably certain as to what the depth is going to be within moderately narrow limits. The trawl was put over at daybreak, and the line veered to 3500 fathoms; and while the trawl was going down the sounding was taken, in the present case at a depth of 2900 fathoms with a bottom of "red clay." In this way the trawl reached the bottom, probably between 7° and 8° C., and we could allow it to drift quietly for at least six hours before beginning to haul in. From a zoological point of view this haul was remarkably successful; there were one or two Fishes, a *Scalpellum*, a number of Annelids (particularly a prominent Aphroditacean), Echinoderms of the genera *Pourtalesia*, *Archaster*, *Brisinga*, and *Antedon*, a fine species of *Cornularia*, several examples of *Fungia symmetrica*, and some *Actiniæ*. The general distribution of temperature remained much the same, the isotherm of 10° C. retaining its position near the 200-fathom line.

We trawled, on the 2nd of July, in 2050 fathoms, with a bottom of light brownish ooze with many *Globigerina*-shells. The bag brought up a number of lumps of pumice, and among them a very characteristic assemblage of deep-sea animals, the most interesting an undescribed species of *Hyalonema*, which occurred in considerable numbers and in an excellent state of preservation. The form of the sponge-body is almost spherical, with a comparatively small oscular opening, and the coil is much shorter than in *H. Sieboldi*, in the largest specimens not more than six inches in length. One remarkable point was that in no case was

there a commensal *Palythoa* connected with this sponge; the coil was always perfectly clean. The spicules of the network and of the sarcode closely resemble those of the Japanese species, but they all present marked specific differences in detail of form.

July 3.—We sounded in 2530 fathoms, with a bottom of reddish-brown ooze ("red clay"), and took temperature-soundings; we afterwards veered the dredging-line to 1500 fathoms with tow-nets, and got many specimens of the usual deep-water Protozoa.

July 5.—We sent down the trawl and afterwards sounded in 2900 fathoms, and took serial temperatures. In the trawl, along with many other deep-sea forms, there was one fine specimen of the large solitary hydroid already referred to (Station 237).

On the 7th we sounded in 3000 fathoms, with the usual bottom of red clay; on the 9th in 3050 fathoms, and on the 10th in 2950 fathoms. The results of the dredgings for the last few stations had been so uniform, and the operation was rendered so critical by the heavy swell from the westward, that we did not consider it necessary to repeat it on every occasion.

On the 12th of July the trawl was lowered at a depth of 2740 fathoms. The net contained very few animals, and was greatly torn and frayed; but in a kind of pocket formed by an accidental folding of the net there were about a cwt. of black mammillated concretions, which, when they were poured out on the deck, had very much the appearance of potatoes. The external surface of the concretion was slightly rough, and a number of small animal forms, particularly a minute rhizopod in a membranous tube, nestled in the crevices. The nature of these concretions will be discussed hereafter.

On the 14th of July we reached the point lat. 38° 9′ N., long. 156° 25′ W., whence we turned southwards towards the Sandwich Islands. For the last few stations the temperature of the water had been gradually sinking, and the influence of the Japan current dying out; the isotherm of 10° C. was now only 100 fathoms below the surface. The depth at this point was 3115 fathoms; we put over the small dredge, as the nature of the bottom had latterly been so destructive to the trawl, and brought up manganese nodules, with a few small sponges and Bryozoa.

On the 17th of July we sounded in 3025 fathoms, the bottom still "red clay," and on the 19th in 2850 fathoms. A serial sounding taken at the latter station to 1500 fathoms showed a considerable rise in the temperatures near the surface, the isotherm of 10° C. having again sunk to a depth of 200 fathoms, and that of 15° C. corresponding with the 100-fathom line. On the 21st the bottom was "red clay" at a depth of 2950 fathoms; the small dredge was lowered and brought up a large quantity of the ooze, very smooth and tenacious, but containing scarcely a trace of living things. The serial temperature-soundings indicated a still further rise in the temperature of the upper layers, due doubtless to progress southwards.

On the 23rd we sounded in 2875 fathoms, and on the 24th in 2775, the bottom in both cases having much the same character which it had maintained throughout the cruise. The Albatrosses, which had followed the ship, to the number of from fourteen to twenty daily, since we left Japan, left us to-day. We saw one or two Boatswain Birds (*Phaëton rubricauda*), and a Turnstone (*Strepsilas interpres*) flew about the ship for some hours, lighting on the combings and the rigging. On the 26th we sounded in 2225 fathoms; and on the morning of the 27th we passed into the strait between the islands of Molokai and Oahu, and trawled on hard ground in 310 fathoms, with but little success. In the evening we anchored in the harbour of Honolulu.

This cruise naturally divides itself into two parts:—a section about 3170 nautical miles in length, including the stations from No. 237 to No. 253, very slightly to the northward of east, between the parallels of 35° and 38° N. lat.; and a meridional section of 1128 nautical miles, along the meridian of 155° W. long. The first of these sections corresponds very closely in relative position with the section in the Atlantic between Sandy Hook and the Açores, and the points of resemblance and difference between them, when fully worked out, must prove most instructive. The two sections cross the two great deflections to the northward of the equatorial current, in the Atlantic the Gulf-stream, and in the Pacific the "Kuro-Siwo;" and the thermic influence of the two currents is fairly contrasted. The influence of the Gulf-stream, if not absolutely greater (and this is a point which it will be somewhat difficult to determine), is at all events much more concentrated and effective, owing to the continuity of the coast-line of the American continent, to the way in which the water of the equatorial current is driven into the Gulf of Mexico and superheated there, afterwards to be kept together and ejected in a defined stream through the Strait of Florida, and to the absence of periodical winds in the Atlantic. In the Pacific, on the other hand, the main flow of the equatorial current is weakened among the passages of the Malayan archipelago; and although a large part of it is directed northwards by the broken barrier formed by the Fiji Islands, the New Hebrides, and Papua, it almost at once enters the region of the monsoons, where it is thwarted for half the year; and it can only be regarded as comparable with that portion of the reflux of the Atlantic equatorial current which passes outside the West-Indian Islands. Nevertheless it passes the south coast of Japan as a very palpable and apparently a permanent current, exercising a very perceptible thermic influence to a depth of at least 300 fathoms.

In traversing the Pacific the influence of the Japan current appears to be gradually lost; while I am still inclined to believe that in the Atlantic the Gulf-stream is banked down against and reflected from the western coast of Europe. It is a question of great complexity; but it seems to me that it is consistent with our experience that the temperature of the

water of the ocean at any one place is due, in a great measure, to the temperature of the source of that water—not entirely due, for in passing through a long distance the temperature of even the greatest masses of water is certainly gradually altered by conduction and mixture.

The suggestions of Dr. Carpenter and Mr. Buchanan that the existence of a deep layer of warm water in the Atlantic might be connected in some way with the mean annual temperature of the area and the absence of ocean-currents, are very suggestive; and I looked forward with great interest to an opportunity of testing them in the corresponding position in the Pacific. But there seems to be no trace of any thing of the kind; as the influence of the equatorial reflux becomes weaker the temperatures fall uniformly.

To show that the conditions in the two oceans differ more in degree than in kind, I give in Plates 3 and 4 curves constructed from serial soundings along nearly corresponding lines in the Atlantic and Pacific. Curves A and B are added on Plate 3 to show the position of the deeper belt of abnormally warm water which makes its appearance near the coast of Europe.

Plate 3.

North-Atlantic Ocean.

No. of Station.	Latitude.	Longitude.	Depth in fathoms.
43	36° 23′ N.	71° 51′ W.	....
44	37 25 „	71 40 „	1700
53	36 30 „	63 40 „	2650
65	36 33 „	47 58 „	2700
69	38 23 „	37 21 „	2200
71	38 18 „	34 48 „	1675
80	35 3 „	21 25 „	2660
A A	In the Bay of Biscay.		2090
B B	Off the coast of Portugal.		1090

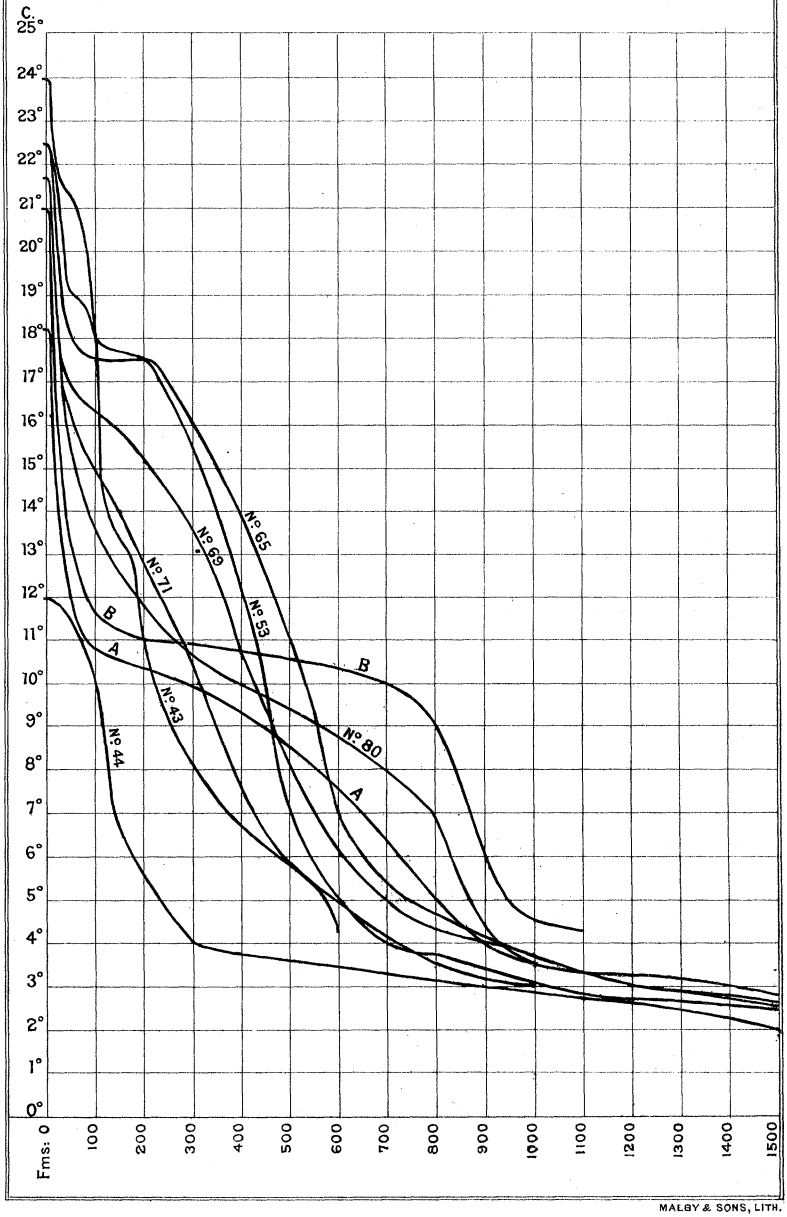
Plate 4.

North-Pacific Ocean.

No. of Station.	Latitude.	Longitude.	Depth in fathoms.
237	34° 37′ N.	140° 32′ E.	1875
240	35 20 „	153 39 „	2900
243	35 24 „	166 35 „	2800
245	36 23 „	174 31 „	2775
246	36 10 „	178 0 „	2050
248	37 41 „	177 4 W.	2900
252	37 52 „	160 17 „	2740

There seems to be little doubt that the enormous mass of cold water which fills up the trough of the Pacific is, like the cold bottom-water of

CURVES CONSTRUCTED FROM SERIAL TEMPERATURE SOUNDINGS IN THE NORTH ATLANTIC.



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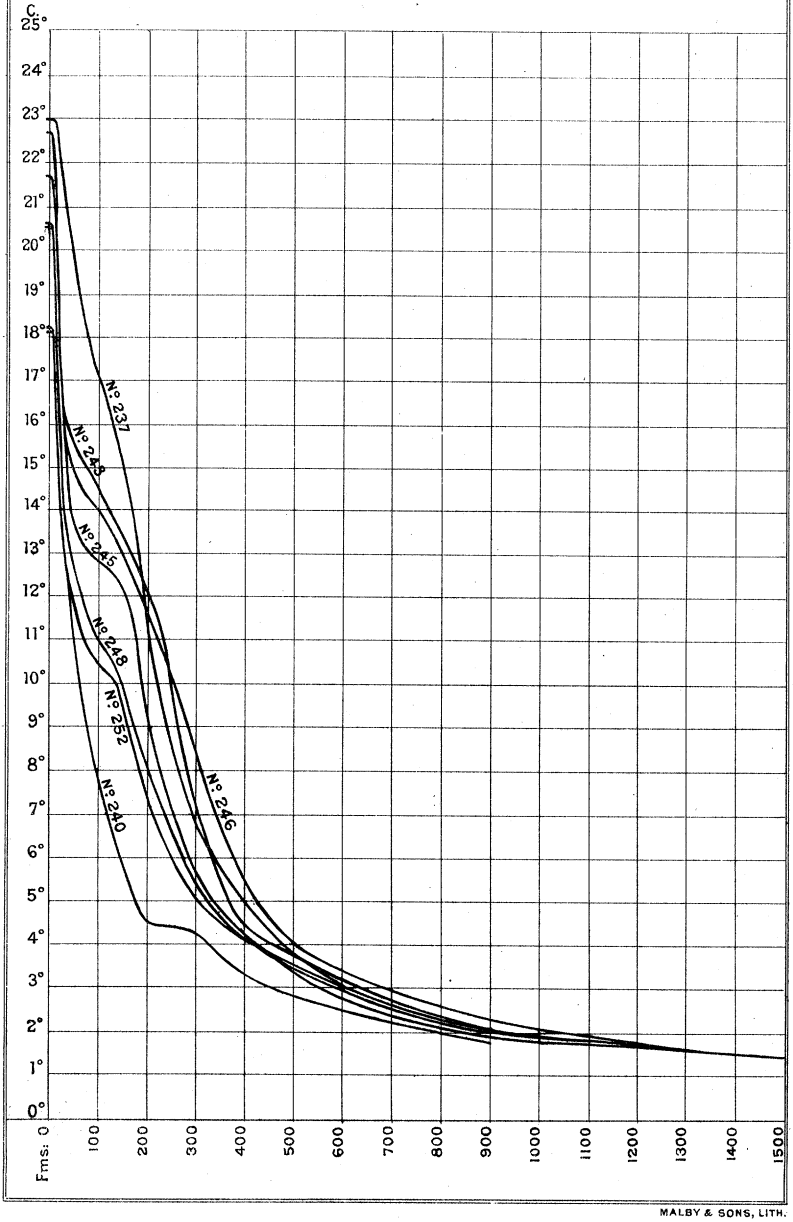
CURVES CONSTRUCTED FROM SERIAL TEMPERATURE SOUNDINGS IN THE NORTH PACIFIC.



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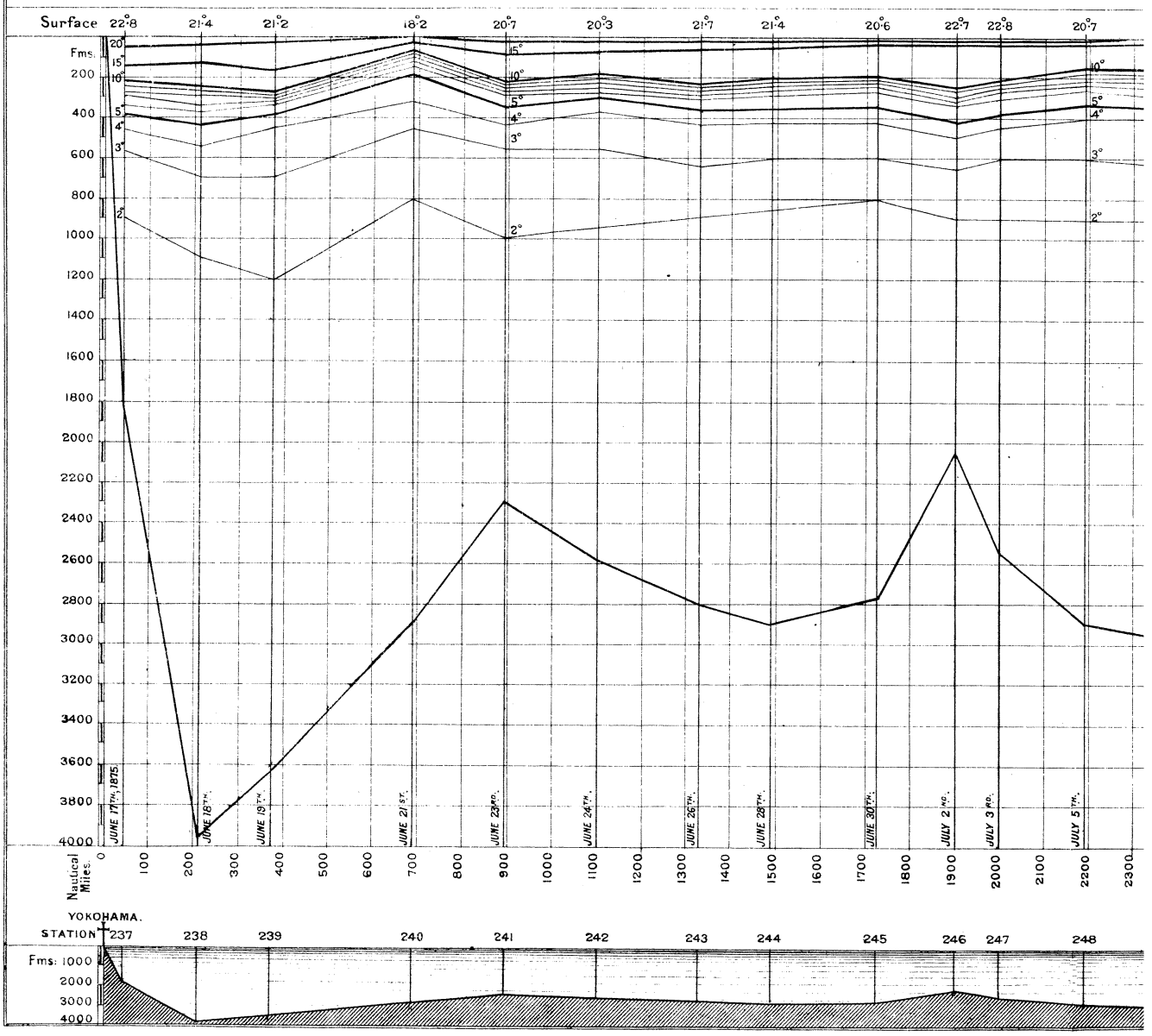

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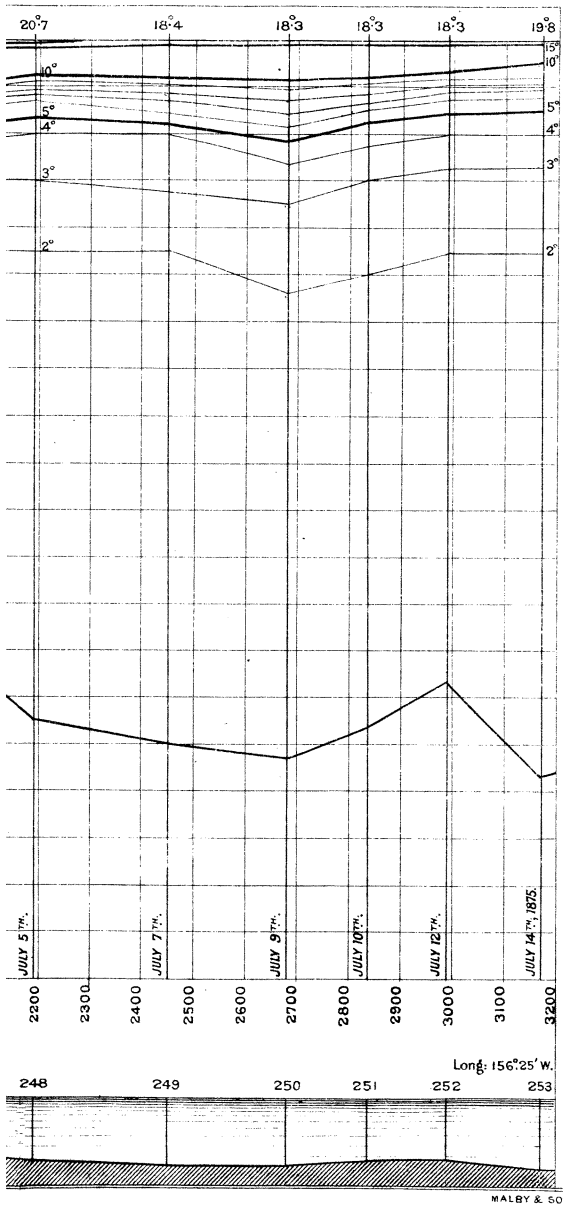
ATION 253.



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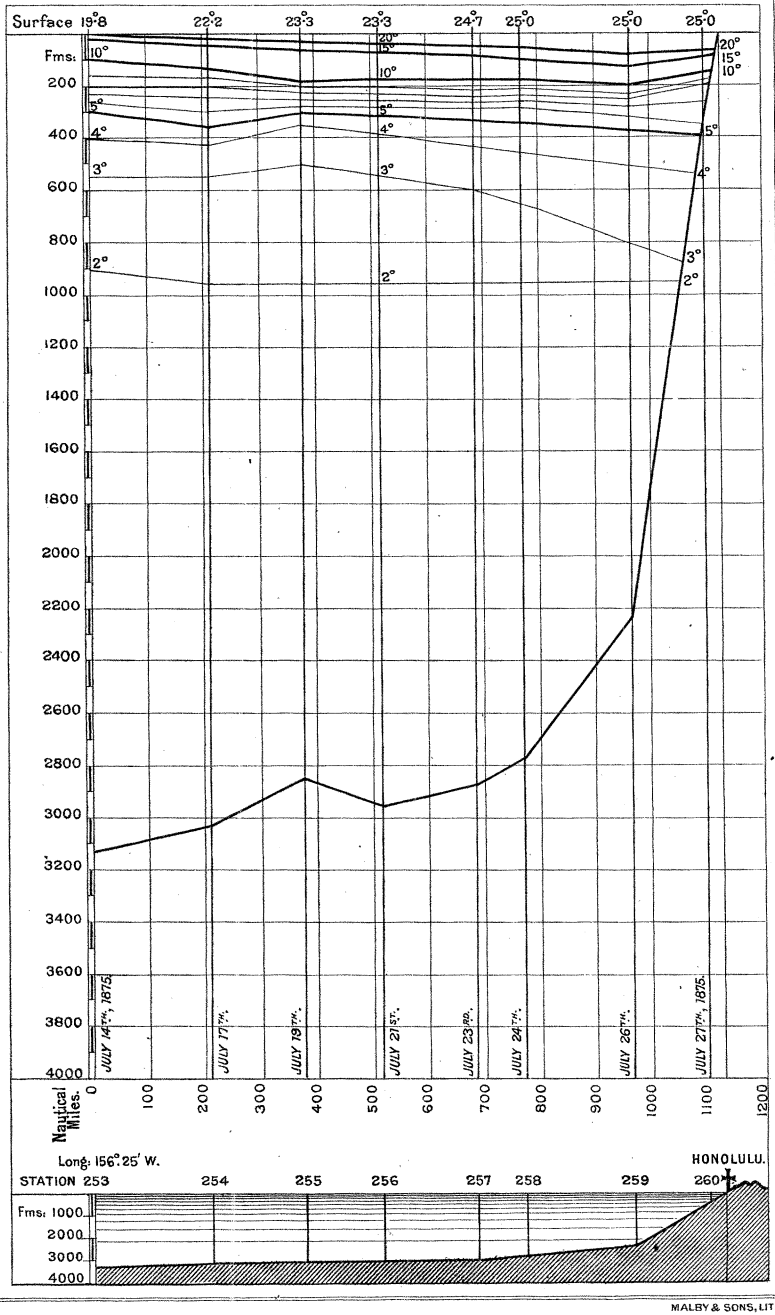

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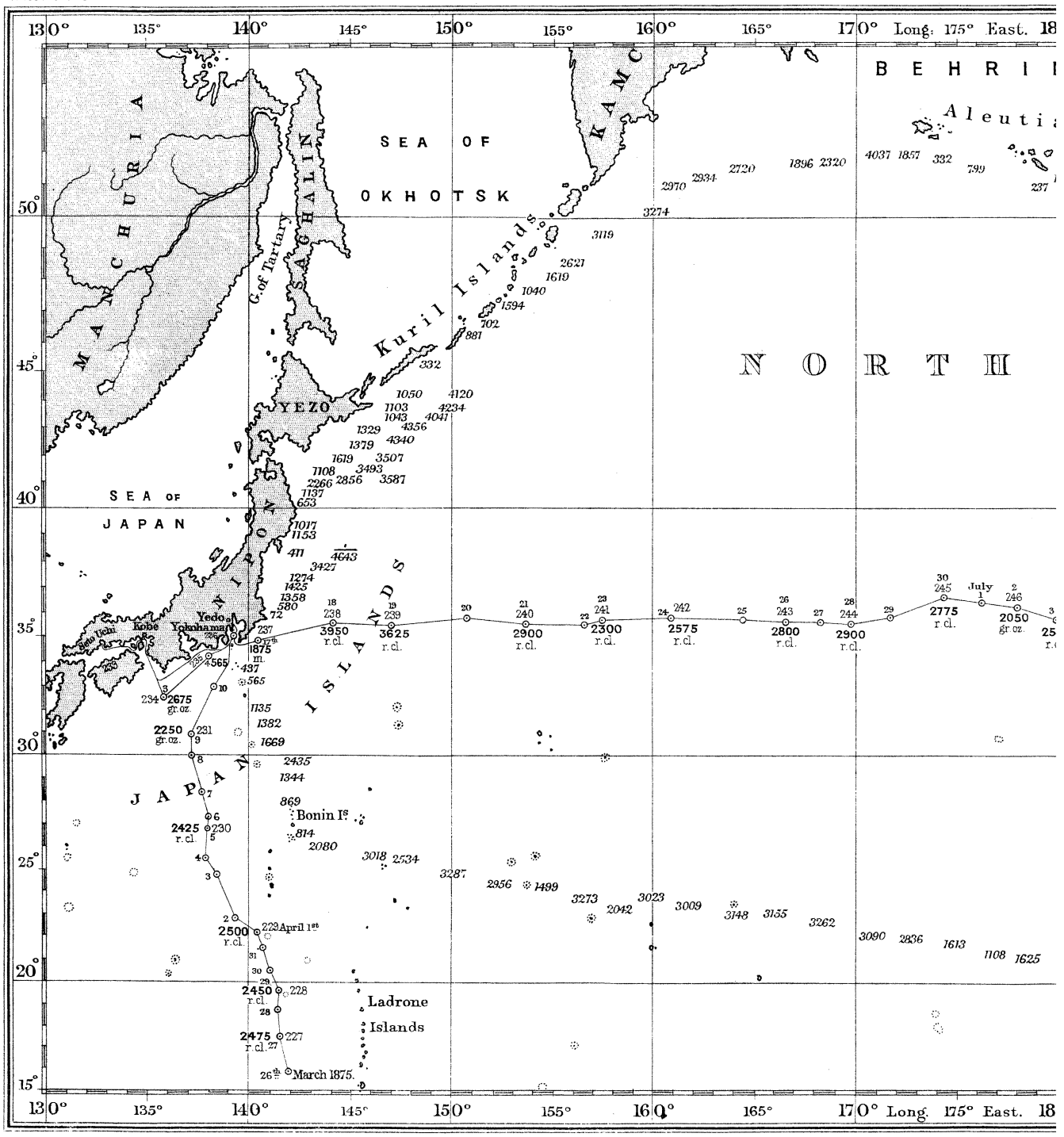
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MANCHURIA
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N O R T H
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JAPAN
NIPON
ISLANDS
Hako Hdte.
Kobe
Yedo
Yokohama
Bonin Is
Ladrone Islands
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437
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1135
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1669
2435
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869
814
2080
3018
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3009
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1896
2320
3274
4565
2675 gr. oz.
2250 gr. oz.
2425 r. cl.
2500 r. cl.
2450 r. cl.
2475 r. cl.
3950 r. cl.
3625 r. cl.
2900 r. cl.
2300 r. cl.
2575 r. cl.
2800 r. cl.
2900 r. cl.
2775 r. cl.
2050 gr. oz.
April 1st
March 1875.
July

East. 180° Long. 175° West 170° from 165° Greenwh 160° 155° 150° 145° 140° 135°

R I N G S E A

e u t i a n I s l a n d s

Fox Islands

Andreanoff Is.

Q. Charlotte Is.

H P A C I F I C O C E A N

SANDWICH ISLANDS

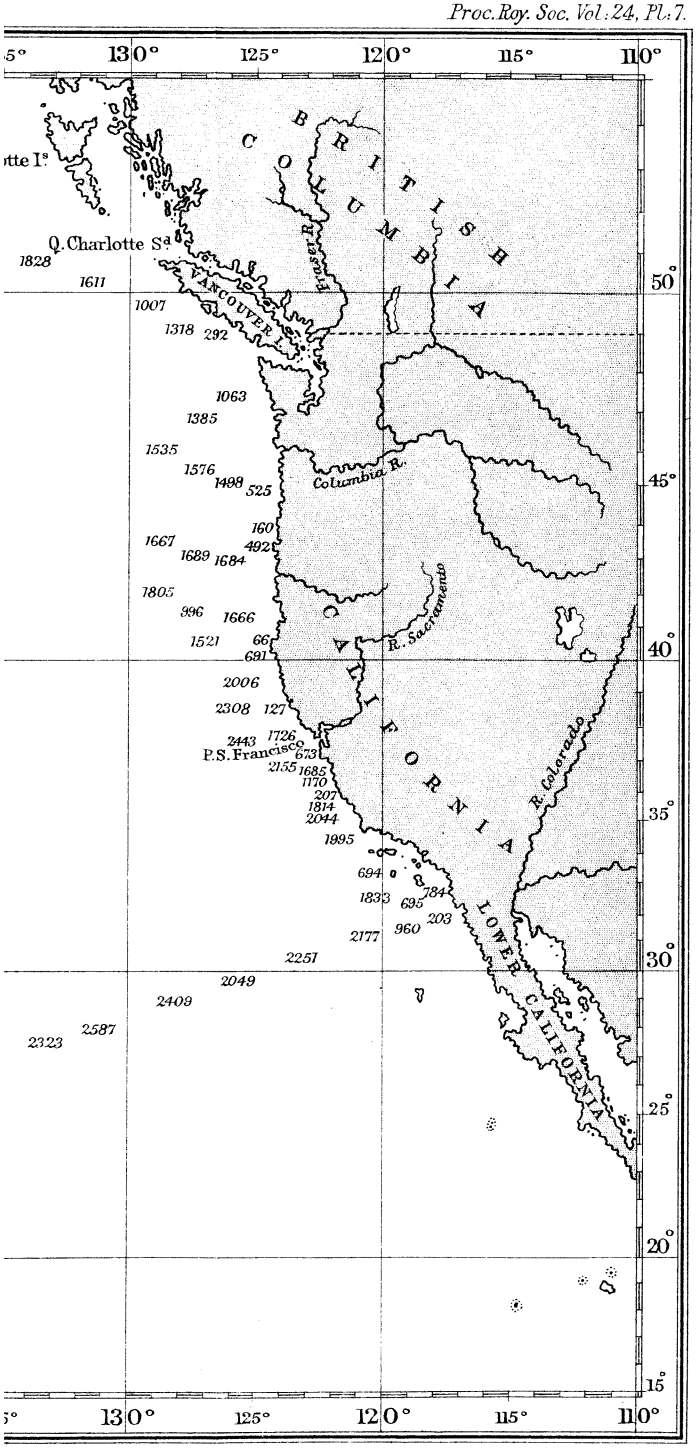
OAHU

Honolulu

HAWAII

Hilo

East. 180° Long. 175° West 170° from 165° Greenwh 160° 155° 150° 145° 140° 135°



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the Atlantic, an indraught from the Southern Sea. The more the question is investigated the less evidence there seems to me to be of any general ocean circulation depending upon differences of specific gravity. It seems certain that, both in the Atlantic and in the Pacific, the bottom-water is constantly moving northwards; and I am now very much inclined to refer this movement to an excess of precipitation over the water-hemisphere, a portion of the vapour formed in the northern hemisphere being carried southwards and precipitated in the vast southern area of low barometric pressure. I hope to enter fully into the discussion of this matter on a future occasion. The temperature of the water is greatly lower in the Pacific for the first thousand fathoms than in the Atlantic in the corresponding latitude of 35° N. There is one very remarkable difference between the two basins: while in the Atlantic it seems certain that the temperature sinks gradually, though very slightly, for the last thousand fathoms to the bottom, it appears that in the Pacific the minimum temperature of 1°·7 C. is reached at a depth not greater than 1400 fathoms, and that from that depth to the bottom the temperature is the same.

The soundings from Yokohama to Honolulu are remarkably uniform in depth, the twenty-two soundings on one line, which are unaffected by the neighbourhood of land, giving an average of 2858 fathoms. The nature of the bottom is also very uniform; and, according to the nomenclature which we have adopted, it is, in each case, noted on the chart as "red clay." It is usually, however, somewhat greyer in colour than the typical "red clay," and contains a large proportion of the tests of siliceous organisms (a proportion which increases with increasing depth), and a considerable quantity of pumice in different states of comminution and decomposition. The clay contains scarcely a trace of carbonate of lime, although the surface swarms with ooze-forming foraminifera. In some cases the trawl came up half full of large lumps of pumice, which seemed to have been drifted about till they were water-logged, and to be softening and becoming decomposed; these pieces of decomposing pumice were often coated and pervaded throughout with oxide of manganese. Over the whole area the red clay was full of concretions, consisting mainly of peroxide of manganese, round, oval, or mammillated and very irregular, varying in size from a grain of mustard-seed to a large potato. When these concretions are broken up, they are found to consist of concentric layers having a radiating fibrous arrangement, and usually starting from a nucleus consisting of some foreign body, such as a piece of pumice, a shark's tooth, or a fragment of any organism—as, for instance, in one case a piece of a Hexactinnelid sponge of the genus *Aphrocallistes*, which was preserved as a very beautiful fossil in the centre. The concretions appear to form loose among the soft clay; the singular point is the amount of this manganese formation, and the vast area which it covers.

We were particularly successful, during this cruise, in getting good samples of the fauna from great depths; and we found that the fauna of

the North Pacific, at depths of from 2000 to 3000 fathoms, although not very abundant in species, is by no means meagre. In each of six dredgings and trawlings at depths greater than 2000 fathoms we found, along with a few Fishes, a fair representation of all the larger invertebrate groups; and in one dredging, No. 253, at a depth of 3125 fathoms, we took a small Sponge, a species of *Cornularia*, an *Actinia*, an Annelid in a tube, and a Bryozoon. We were again struck with the wonderful uniformity of the fauna at these depths; if not exactly the same species, very similar representatives of the same genera occur in all parts of the world.

I am glad to be able to report that every thing is going on in a satisfactory way in the departments under my charge.

I have the honour to be, Sir,

Your obedient Servant,

C. Wyville Thomson,

Director of Civilian Scientific Staff on board H.M.S. 'Challenger.'

Captain Evans, C.B., F.R.S., Hydrographer, Admiralty.

II. "On the Physiological Action of Vanadium." By John Priestley, Platt Physiological Scholar, the Owens College, Manchester. Communicated by Prof. Gamgee, F.R.S. Received June 18, 1875.

(Abstract.)

The author has divided his paper into four sections.

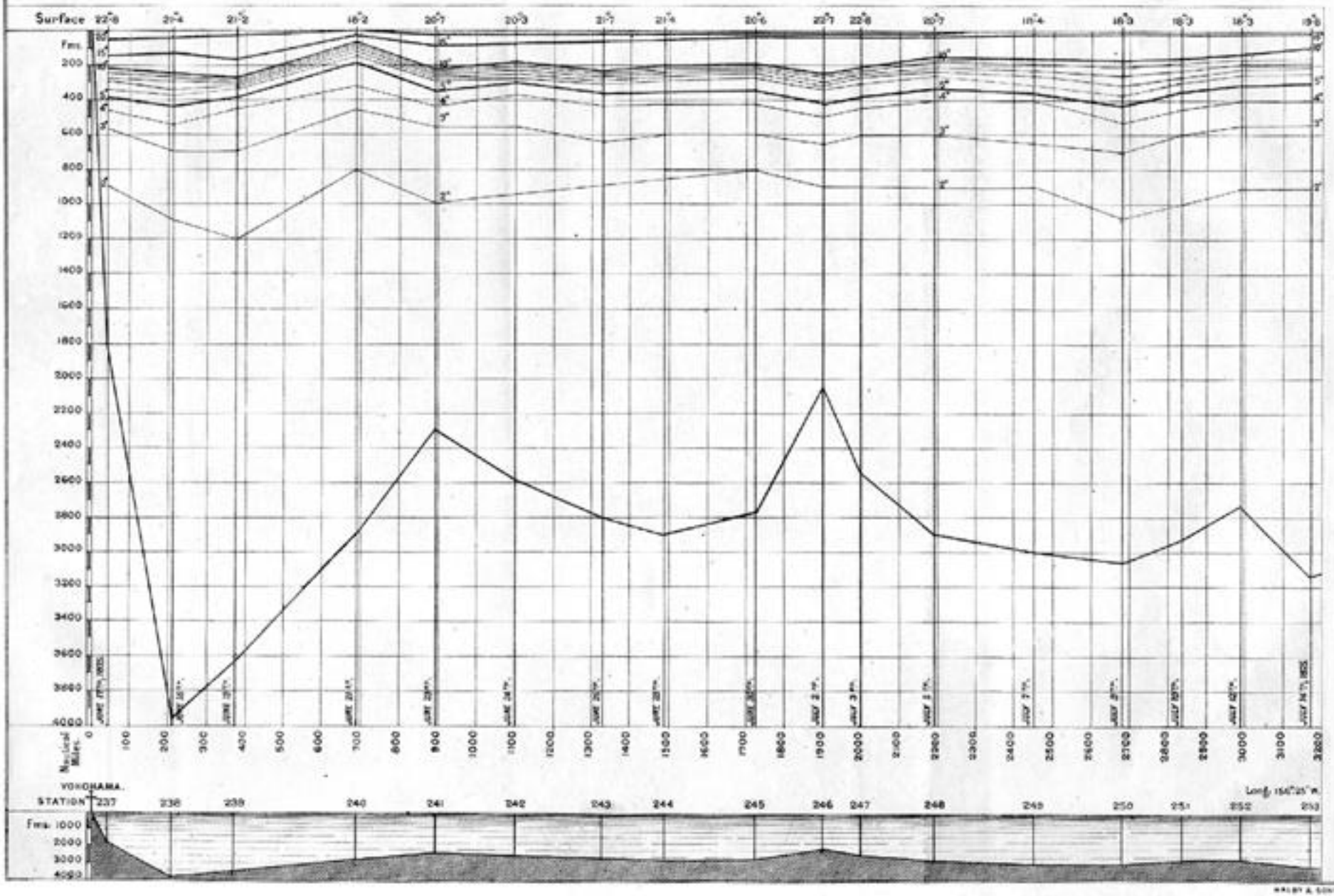
In the first the subject is introduced by a brief statement of the relationships of vanadium to other elements of the same and of allied groups; and the main object of the research is set forth, viz. by an extended investigation to endeavour to fix the physiological relationships of vanadium to the closely allied elements arsenic and phosphorus, so as to throw some light on the relations which probably exist between the chemical and physiological properties of the elements. The tribasic sodium vanadate (Na_3VO_4) is stated to have been the compound of vanadium made use of throughout the research, and the reasons of the preference are given.

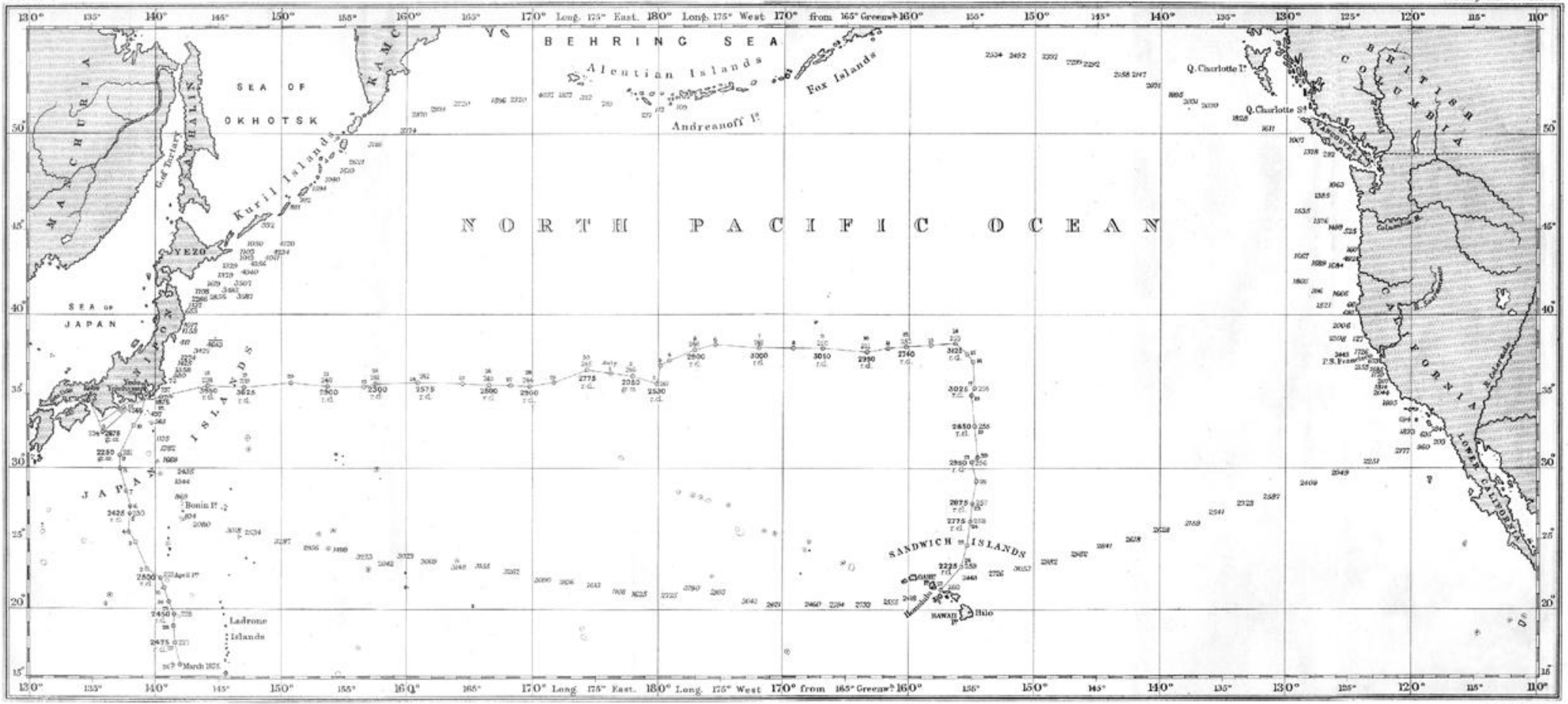
In the second section the action of solutions of sodium vanadate upon simple organisms is shortly illustrated by the details of four sets of experiments, from which the conclusion is drawn that all solutions, except those which are extremely dilute (*i.e.* which contain only so much salt as corresponds to ·01–·5 per cent. of V_2O_5), act injuriously upon the simpler organisms.

In the third section the effects of vanadium in the above combination on complex organisms are discussed under two heads, viz.:—

A. The general action on the animal system when introduced by

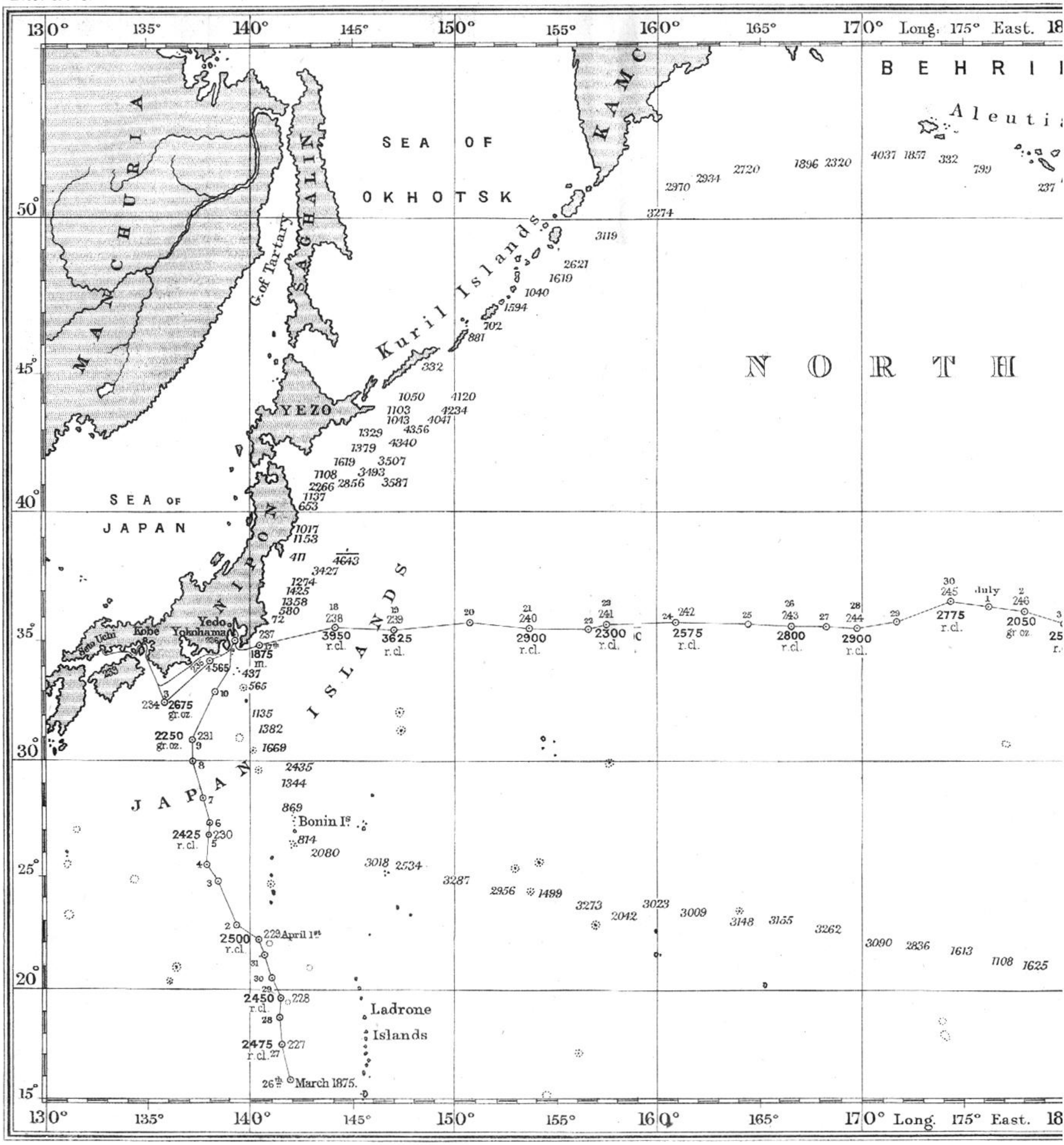
DIAGRAM SHOWING THE VERTICAL DISTRIBUTION OF TEMPERATURE FOR THE SECTION BETWEEN YOKOHAMA AND STATION 253.





Malby & Sons, Lith.

Thomson.


130° 135° 140° 145° 150° 155° 160° 165° 170° Long. 175° East. 18
50°
45°
40°
35°
30°
25°
20°
15°
MANCHURIA
SEA OF OKHOTSK
KAMC
BEHRI
Aleuti
4037 1857 332 799 237
2970 2934 2720 1896 2320
3274
3119
2621
1619
1040
1594
702
881
332
G. of Tartary
SAGHALIN
Kuril Islands
NORTH
YEZO
1050 4120
1103 4234
1043 4041
1329 4356
1379 4340
1619 3507
1108 3493
2266 2856 3587
1137
653
SEA OF JAPAN
NIPON
1017
1153
411 4643
3427
1274
1425
1358
580
72
Yedo
Yokohama
Kobe
Sino Uchi
238 239 237 236 235
3950 r.cl.
3625 r.cl.
1875 m.
4565
437
565
1135
1382
1669
2435
1344
869
Bonin Is
814
2080
3018 2534
3287
2956 1499
3273 2042
3023
3009
3148 3155 3262
3090 2836 1613 1108 1625
ISLANDS
JAPAN
18 19 20 21 22 23 24 25 26 27 28 29 30 July 1 2
238 239 240 241 242 243 244 245 246
3950 r.cl. 3625 r.cl. 2900 r.cl. 2300 r.cl. 2575 r.cl. 2800 r.cl. 2900 r.cl. 2775 r.cl. 2050 gr oz.
234 2675 gr.oz.
2250 gr.oz.
2425 r.cl.
2500 r.cl.
2450 r.cl.
2475 r.cl.
March 1875.
April 1st
Ladrone Islands

East. 180° Long. 175° West 170° from 165° Greenwh 160° 155° 150° 145° 140° 135°

R I N G S E A

Fox Islands

eutian Islands

Andreanoff Is

Q. Charlotte Is

H P A C I F I C O C E A N

SANDWICH ISLANDS

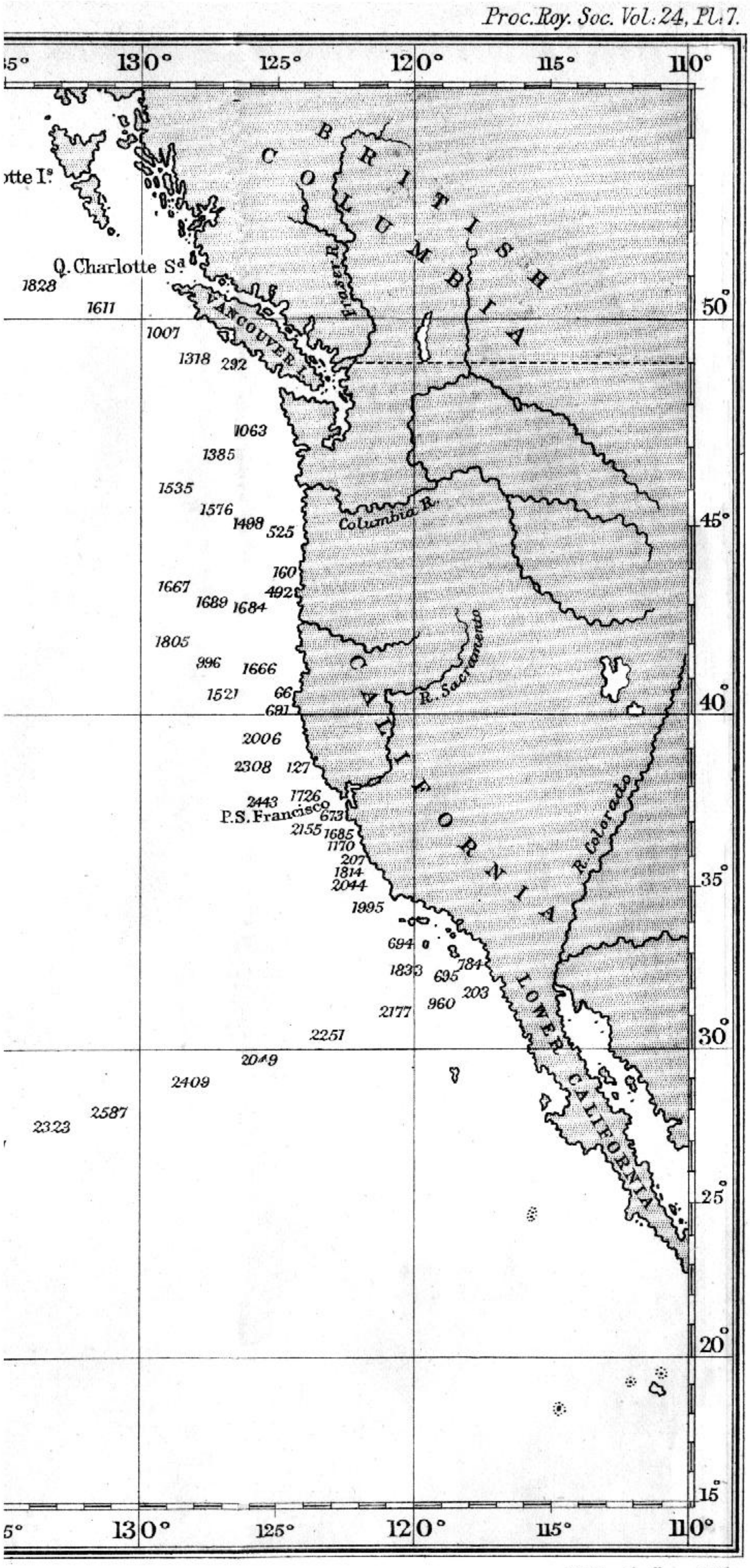
OAHU P.

Honolulu

HAWAII P.

Hilo

East. 180° Long. 175° West 170° from 165° Greenwh 160° 155° 150° 145° 140° 135°



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